Appendix C

Tactical Airspace Integration System

The Tactical Airspace Integration System (TAIS) is a battlefield automated system designed to meet both Army airspace command and control (A2C2) and air traffic service (ATS) airspace information center (AIC) requirements. Its role is to digitize the A2C2 and ATS en route airspace management processes at the echelons of division and above. The TAIS is composed of two transparent subsystems, allowing flexibility of use based on mission, enemy, terrain and weather, troops and support available, time available, civil considerations (METT-TC).

TAIS OBJECTIVES

C-1. The primary objectives of TAIS are to—

- *Integrate and synchronize.* TAIS fully integrates and synchronizes all operations in the third dimension of that battlespace delegated to the tactical commander. It assists in integrating and synchronizing the airspace controlled by the airspace control authority (ACA).
- *Deconflict.* TAIS immediately deconflicts operational airspace according to the tactical commander's priority of airspace usage or real-time decision. It promptly assists in deconflicting airspace controlled by the ACA.
- *Increase flexibility and offensive capability.* TAIS increases the tactical commander's flexibility and offensive capability by maximizing opportunities of continuous operations in time, location, and dimension.
- *Digitize and automate A2C2.* TAIS establishes transparent A2C2 planning and operations procedures through digitization and automation. It ensures this transparency extends to the supported AIC functions.
- *Reduce workloads.* TAIS reduces tactical staff workloads using automation. Its sensor inputs and digital position reports should reduce ground-to-air voice communications.

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- *Improve Theater Air-Ground System (TAGS) interface.* TAIS provides the tactical commander an improved near real-time interface with the TAGS.
- *Integrate with Army Battle Command System (ABCS).* TAIS communicates, shares, and coordinates airspace information with each ABCS.
- *Modernize AIC capabilities.* TAIS upgrades and integrates area and en route ATS support through automation and modernized communications. It is the primary tool that integrates all ATS assets into an Army airspace management system.
- *Enhance global interoperability.* TAIS enhances interoperability with joint, multinational, and civil command, control, communications, computers, and intelligence systems.

C-2. The A2C2 element and AIC maintain the same operational airspace picture at each echelon. The operational picture and AIC communication capabilities meet the joint prerequisites for delegation of airspace. TAIS provides the command, control, communications, and computer capabilities so the ACA can more easily manage greater blocks of assigned airspace. Other TAIS capabilities include—

- Automated assistance to A2C2 planning and operations (four-dimensional, tailorable, digital airspace overlay), coordination, monitoring of the air operations (including airspace usage), and time-sequenced rehearsal.
- Full digital and analog, multiband communications and flight following capability for AIC operations.
- Digital receipt and processing of an airspace control order (ACO), the related digital messages from the Theater Battle Management Core System (TBMCS), ABCSs, and the digital templates to readily convert analog information.
- Providing the unit airspace plan (UAP) with airspace data and overlay. Note: The UAP is accessible by other ABCSs via the United States message text format (USMTF) and airspace overlay provider.
- Processing inputs from multiple sensors for a near real-time display and tracking of air vehicles or air vehicle self-reporting.
- Tactical Internet (TI) capability between all systems of TAIS in their respective theater for airspace information flow and management.
- Area support to other ATS terminal and forward support operations, such as a flight plan relay, notice to airmen, weather update, and air warnings.
- An interface with all joint, combined, civil, and military airspace control agencies.
- Processing tactical digital information link (TADIL)-A, TADIL-B, TADIL-J, and a Transmission Control Protocol (TCP) data link, and an Internet Protocol (IP) forward area air defense (FAAD) data link for air track information.

SYSTEM DESCRIPTION

C-3. A complete TAIS consists of two identically mobile subsystems. Each is a modified standard Army shelter mounted on an expanded capacity vehicle, a

HMMWV variant. Each assembly is also equipped with a soft-sided shelter and tows a trailer-mounted (15 kilowatts) tactical quiet generator. Additional cargo vehicles authorized to the unit will carry the remaining equipment and common table of allowance items.

C-4. Each TAIS shelter contains an Air Defense System Integrator (ADSI)—the AN/TSQ-214(V). The ADSI consists of three significant modules: the tactical situational display, the router, and the master database. The ADSI can accept inputs from up to 15 external TADILs, TCP data links, IP FAAD data links, and sensor-linked data from various digital radar systems. The ADSI fuses these inputs of real-time airspace user data to create a near real-time A2C2 air picture. TAIS also contains an extensive communications suite to provide jam-resistant, real-time, secure, and nonsecure voice and data transmission and reception.

C-5. The "heart" of each TAIS vehicle is the group of TAIS workstations. Using ABCS common hardware and software, two workstations are permanently mounted inside the shelter with two additional remote workstations in operational transit cases that can be remoted up to 2000 meters (basic issue cabling limits this to 500 meters). These workstations support ABCS local area network (LAN), TI, and the near real-time A2C2 air picture by displaying digital aircraft. The workstations also use airspace management software capable of near real-time airspace deconfliction and two- or three-dimensional displays of the airspace common operational picture. Airspace deconfliction consists of two activities:

- Planning. Deconflicting planned airspace activities maximizes airspace usage and the application of combat power in a synchronized and safe manner.
- Operations. Modifying or adding airspace control measures (ACMs) and other effects such as weather must occur in near real-time to support battlefield flexibility, maneuver, and decisive action.

C-6. TAIS also contains software that supports the ATS AIC function, using the near real-time four-dimensional A2C2 air picture. The AIC mission, as the ground-to-air link, maintains a common operational picture of the battlespace and digital communications to ensure reliable connectivity beyond line of sight. Digital connectivity and position reporting reduce the voice communications requirements of the AIC and the airspace users. Nevertheless, all airspace users still must monitor the controlling facility's frequency in accordance with joint doctrine.

TAIS MISSION

C-7. TAIS provides automated A2C2 planning, enhanced A2C2 operations, and improved theater, intracorps, intercorps, and division ATS AIC support. TAIS can effectively synchronize battlespace in the third and fourth dimensions (altitude and time, respectively). Simultaneously, it interfaces with civil and interagency authorities as well as joint command and control (C2) nodes and air users. The combination of these capabilities manages battlespace to support force operations while minimizing fratricide.

C-8. The capabilities of TAIS facilitate executing existing airspace management tactics, techniques, and procedures and provide the methodology to

plan, implement, and execute the integrated airspace control function for the Army. A single TAIS must be able to support two major functions. The major functions include—

- A2C2.
- A2C2 planning.
- A2C2 operations.
- Airspace information services.
- AIC operations.

A2C2

C-9. TAIS requires data input from the A2C2 element to provide the G3 air with automated planning assistance and full connectivity to higher airspace authorities. It also provides the G3 air with a near real-time complete or tailorable, common operational picture.

A2C2 PLANNING

C-10. TAIS fully integrates A2C2 planning methods and procedures digitally and automatically by interfacing with TBMCS and ABCS. TAIS receives both the projected battlefield plan (to include graphics) and planned airspace usage information digitally or by manual input. It then correlates the input information to assist the deconfliction of airspace (including preset commander priorities, prompted decisions, or manual tailoring by operators). TAIS continues this automated "building block" process over the planned operational time period until all the ACO and the unit's A2C2 overlay include pertinent airspace usage requirements. For A2C2 planning and deconfliction, TAIS graphically displays two- and three-dimensional control measures as selected by the operator. TAIS can graphically project proposed ACMs and ACOs in time (the fourth dimension), disseminating them as a deliverable throughout the ABCS and TBMCS. Additionally, TAIS produces a template for the requisite A2C2 orders, annexes, and overlays, collectively called the unit airspace plan. The ACOs, operation orders, overlays, and ACMs produced in the planning phase enable the operations phase to occur. They are dynamically presented throughout that phase for A2C2 operational monitoring and updating.

A2C2 OPERATIONS

C-11. TAIS fully integrates A2C2 operational methods and procedures digitally and automatically into the total common operational picture process by interfacing with the ABCS and TAGS. TAIS provides the capability to—

- Monitor execution of ACMs and ACOs dynamically by time.
- Identify and propose resolutions of actual or imminent airspace conflicts in near real-time.
- Automatically modify and redistribute a revised UAP (or individually modified ACMs) as an update to the common operational picture process.
- Accept and deconflict near real-time airspace usage changes (either automatic receipt or manual input).

AIRSPACE INFORMATION SERVICES

C-12. The airspace information services have one function. They satisfy the air traffic controller requirement to visualize the unit airspace plan and then to directly communicate to air vehicles for executing the various options of airspace control, from procedural to positive.

AIC OPERATIONS

C-13. The methods and procedures of the airspace information center are characterized by digital and automated operations that include flight following, nonintrusive information exchanges by data burst, digital radar-fed representations, and modernized voice and data radio communications equipment. An A2C2-designated TAIS can pass planned operational information and accompanying overlays to the TAIS performing the AIC function. This allows air traffic control personnel to understand the scheme of maneuver. They can, in turn, provide feedback to the A2C2 system for near real-time operational changes to the airspace. Information about other effects on airspace usage—such as weather; enemy operations; and nuclear, biological, and chemical (NBC) contamination—can be readily transmitted to air vehicles to protect them within the battlespace. The AIC function also integrates other ATS systems within its area of coverage into the airspace management system.

TAIS FUNCTIONS

A2C2 FUNCTIONS

C-14. As discussed earlier, the TAIS provides the automated assistance for conducting A2C2 operations by performing planning and operation tasks. This section outlines and defines the critical tasks associated with the planning and operation functions.

A2C2 PLANNING

C-15. To conduct A2C2 planning, the TAIS will receive planning data (automated and manual), process planning data, deconflict A2C2 activities, and develop A2C2 deliverables. The TAIS will also transmit A2C2 deliverables (by appropriate ABCS means) directly to a Maneuver Control System (MCS) or other C2 systems with a validated user interface requirement. Through near real-time digital interfaces to the ABCS and TBMCS, TAIS automation allows prompt correlation, deconfliction, and synchronization of airspace and ground information, expeditiously assisting A2C2 methods and procedures. TAIS can complete several associated tasks:

- Process and display airspace control measures for an air tasking order.
- Receive ACMs from ARFOR elements.
- Receive ACMs from ARFOR elements.
- Input or edit.
- Deconflict ACMs and process them to the appropriate echelon.
- Provide feedback to ARFOR elements on ACM submissions.
- Display unit airspace plan.
- Construct, store, display, and share A2C2 overlay.

Process and Display Airspace Control Measures for an Air Tasking Order

C-16. The TAIS can identify and select the appropriate National Imagery and Mapping Agency (NIMA) map for loading through automatic and manual map selection. Based on map data codes received from automated data or graphics, the TAIS will automatically identify and add the planning activity database and planning display with the appropriate NIMA map data. Based on manual input, the TAIS will add the planning activity database and planning display with the designated NIMA map. The TAIS will also reference and affix the appropriate automated NIMA map data identification and recognition codes to any transmitted product generated from the TAIS. This action will allow other battlefield automated systems (BAS) to automatically recognize and upload a NIMA map pertaining to a TAIS-generated product. The TAIS two-dimensional window—the joint mapping tool kit—displays both digital terrain elevation data (DTED), levels 1 and 2. The TAIS three-dimensional window—the Dynamic Airspace Management System—currently displays DTED level 2 data in three dimensions.

C-17. The TAIS will receive the air tasking order (ATO) either through the MCS or by direct link from the joint force air component commander's (JFACC's) automated airspace control system. The ACMs identified in the ACO will be processed and displayed over the appropriate NIMA map selection.

Receive ACMs from ARFOR Elements

C-18. The TAIS receives requests for operational airspace reservations for multiple users. Functionally, under the ABCS, the TAIS and MCS will receive these messages from all Army Tactical Command and Control Systems (ATCCSs). The ATCCS nodes would have received these messages from subordinate supporting systems that represent units (airspace users). To facilitate A2C2 planning and coordination, the TAIS identifies and receives ACM requests, battlefield planning data, and graphics from five ARFOR sources:

- Maneuver.
- Fire support.
- Air defense artillery.
- Intelligence.
- Combat service support.

Input or Edit

C-19. The TAIS can manually input or edit any required data or graphics. An operator must enter the tabular data through the keyboard. The operator can manually enter any and all data that could otherwise be received digitally. This manual input function will support nonautomated airspace users or their planning headquarters. The operator also can input a new graphic or edit an existing graphic through a free-draw, on-screen activity.

Deconflict ACMs and Process Them to the Appropriate Echelon

C-20. A2C2 deconfliction operations consist of identifying and resolving operational conflicts for using airspace by two or more airspace users. User

requests or operational requirements for airspace usage with the same location, time, and altitude generate an airspace usage conflict.

C-21. For A2C2 purposes, ACMs are used to designate operational airspace for specified uses, users, locations, times, and altitudes. The TAIS automatically receives message sets and graphics that delineate ACM requests by parameters of use, user, location, time, and altitude. Additionally, the TAIS automatically determines and prepares ACMs for weapons and activities based on locations and missions derived from other shared, automated battlefield information. The TAIS operator also can manually input ACMs either through data input or free-draw, on-screen graphics that are internally converted to data. Both manual means also delineate ACM parameters in location, time, and altitude.

C-22. As the TAIS receives this ACM data, the system automatically stores the data and graphically plots the data on the planning map. Simultaneously, the system compares the parameters of each ACM resident within the database for any overlap in location, time, and altitude.

C-23. If comparison of all ACM parameters yields no conflict, then the cumulative set of ACMs will be considered deconflicted. Any overlap in which two or more airspace users might be in the same location, time, and altitude defines ACMs in conflict. For the TAIS, this equates to when any two "airspace volumes" overlap during the same time plot. Hence, two or more ACMs at the same time and altitude, but at different locations are not in conflict. Two or more ACMs at the same location and altitudes but at different times would likewise not be in conflict. Two or more ACMs at the same time and altitude with a location overlap would be in conflict.

C-24. Once the TAIS has determined that two or more ACMs have some level of overlap in all three parameters of location, time, and altitude, the TAIS proposes the ACMs as conflicting. The TAIS uses three means to identify the ACMs as conflicting:

- *Highlight ACM graphics in conflict*. Once the TAIS identifies ACMs in conflict, their graphic depiction on the planning screen is visually highlighted by a significant contrast change, color change, or blinking. The operator cannot remove this visual highlighting. It is only removed when a satisfactory conflict resolution has been selected or inputted into the TAIS.
- *Display text warning box*. Simultaneously with the visual highlighting, a text warning box appears on the screen notifying the operator of an airspace conflict. The operator can remove this box from the screen. When on the screen, the box automatically generates a separate table that will record information on the ACMs in conflict and track the status of all conflicts. The operator can retrieve this table for checks on conflict resolution. No A2C2 deliverables may be constructed or transmitted without a resolved status on each recorded conflict.
- *Initiate audio alarm*. Simultaneously with the visual highlighting and the text warning box, an intermittent audio alarm sounds as an additional warning to the operator for identified airspace in conflict. When an ACM is added into an ACO or UAP, the operator will get an alert and a visual display of all the ACMs in conflict. The TAIS also has

boundary alerts. When an air track enters, exits, or flies outside its boundary, the operator will be alerted. The operator can then contact the aircraft (pilot) via voice communications. In the A2C2 planning mode, the operator can remove this alarm, but it will return if conflict resolution is not reached prior to finalizing the UAP.

C-25. Once the TAIS has identified an airspace conflict, the next step is to resolve the airspace conflict to allow synchronized operations. Commanders generate initial priority of airspace usage listings for airspace users in their command. To avoid the absolute loss of lower-priority airspace usage requests and to provide maximum flexibility to the commander, airspace conflicts will be resolved with the least operational impact to all proposed users. For A2C2 purposes, two methods exist to resolve airspace conflicts. One is to change one or more of the ACM parameters to eliminate the conflict, the second is to accept the risk and take no action.

Provide Feedback to ARFOR Elements on ACM Submissions

C-26. When an ACM is approved, the commanding organization of the airspace users will be notified of the action. Two notification methods are used:

- Notification by data communication (preferred). This function is an automated data message (query and response free-text message) that is automatically formatted, addressed, and presented to the TAIS operator for transmission approval. The TAIS operator also can manually construct a free-text data message. The TAIS internally generates and maintains a retrievable status report on these messages.
- Notification by voice communication. This function is a voice communication from the TAIS operator to the requesting agency.

Display Unit Airspace Plan

C-27. At operator demand, the UAP is displayed on the TAIS display. This display can be an operator-selectable presentation (simultaneous or sequential) of ATO data tables (window, split, or full screen), A2C2 annex information, and the A2C2 overlay on one workstation; an individual presentation of these items on three workstations; or any combination of the above. Once the UAP has been developed, the TAIS internally designates and stores this plan as a retrievable entity.

Construct, Store, Display, and Share A2C2 Overlay

C-28. The A2C2 overlay is the most representative TAIS product of the UAP. In A2C2 planning, the A2C2 overlay, when joined with the NIMA map background and other battlefield graphics, provides a projection of a two- or three-dimensional common operational picture (COP) over time (the fourth dimension). The A2C2 overlay has four stages:

- *Construction*. The A2C2 overlay is simultaneously reconstructed with new A2C2 planning information. This process involves internal steps that dynamically reconstruct the A2C2 overlay in a "build" mode as ACM data or graphics are received, processed, and approved. The A2C2 overlay "build" function is constant regardless of the display option selected (on or off). In A2C2 planning, the A2C2 overlay is generally displayed to give planners the required COP for overall tactical

planning. When ACM requests are received, they should be added to the A2C2 overlay as "unapproved" ACMs. Unapproved ACMs are displayed in a checkerboard pattern vice the solid pattern of approved ACMs.

- *Store*. Once the A2C2 overlay data set has been developed and collated, the TAIS internally designates and stores this overlay as a retrievable entity.
- *Display*. The A2C2 overlay display function is clearly the most critical requirement in A2C2 planning. Significant on-screen initial planning and planning changes (manual inputs) will be performed during the A2C2 planning mission mode. On-screen planning changes are automatically converted to data sets in the TAIS database. The A2C2 overlay is correlated to NIMA map background data and display graphics (other overlays). Operator-selectable display options coupled with the decluttering capability are critical capabilities. In addition to graphics and display options, the following operator-selectable A2C2 overlay display options will be available:
  - Selection of effective times. This option serves to partition a portion of the A2C2 overlay display and reduce the number of graphics present on the display screen for a set time frame. In A2C2 planning, the A2C2 overlay correlates to the overall UAP by scheduled execution times.
  - Selection of start time. Self-explanatory.
  - Selection of stop time. Self-explanatory.
  - Selection of A2C2 measures. Another method to reduce the number of graphics present on the display screen, or to limit the focus to specific types of ACM measures, is to select only certain A2C2 measures for display.
- *Share*. The TAIS overlay provider gives several capabilities to other ABCSs. They can pull the current A2C2 overlay from TAIS using a direct socket TCP or IP connection, display the overlay on their screens, monitor it as a dynamic product that will refresh and update as TAIS makes changes, and get more detailed information on any airspace control element by right clicking on that element.

A2C2 OPERATIONS

C-29. A2C2 actions taken during the planning cycle are one aspect of the A2C2 process. Reacting to changes in the tactical situation during the conduct of the battle requires similar A2C2 actions (A2C2 operations). Although similar, these actions are characterized by time sensitivity (near real-time). A2C2 operations demand immediate action not required in A2C2 planning. While executing tactical missions, changes in missions are received (location, time, or altitude for A2C2 purposes), the situation is evaluated, and requirements for airspace and potential conflicts between airspace users are identified. Then options are proposed, selected, coordinated, and implemented to resolve the conflicts and synchronize the forces. These critical tasks are associated with A2C2 operations:

- Display digital situation map of area of interest.
- Monitor battle tempo.

- Adapt to unit airspace plan change.
- Deconflict airspace usage and process to the appropriate echelon.
- Provide feedback to ARFOR elements on airspace usage.
- Forward ACMs and airspace usage conflicts to affected elements.
- Revise the unit airspace plan.
- Retransmit A2C2 deliverables.

Display Digital Situation Map of Area of Interest

C-30. The TAIS displays the execution plan, which includes operational overlays, while displaying near real-time COP data. With numerous overlays—such as maneuver and fire support—covering an extended execution period, display saturation can occur. Once A2C2 operations are initiated, the TAIS operator receives a prompt with these segmenting options:

- *Select all COP information.* This functional selection is the default setting and displays all COP information (both planning and real-time) available for the identified operation.
- *Select COP by time period*. This functional selection has a dual selection capability. One is a designated time period correlated to the operation (such as H-hour to H + 1.00 hour, H + 1.5 hour, or H + 2.00 hour); the other is a designated time period by date-time group, such as 240600Z OCT 96–250600Z OCT 96.
- *Select COP by units.* This functional selection displays the COP of only those units or participants designated by the TAIS operator.
- *Select COP by data*. This functional selection displays the COP generated by TAIS operator-selected data or data sets, such as boundaries, locations, and objectives.
- *Select COP by graphics*. This functional selection displays the COP generated by TAIS operator-selected graphics or graphic sets, such as graphics by category—battle positions, assembly areas, or phase lines.
- *Select COP by activity*. This functional selection displays the COP for identifiable portions or phases of an operation, such as attack, defense, consolidation, or designated (Phase I, II, or III).
- *Select no COP information.* This functional selection displays no common operational picture.

C-31. In conjunction with COP segment selection, the TAIS operator also must further declutter the active display. Generally, he declutters this display after COP segmentation to further reduce screen saturation or to tailor the common operational picture display for specific A2C2 operations functions.

Monitor Battle Tempo

C-32. A key element in successful A2C2 operations is executing the planned airspace activities within the parameters reserved for these activities. During dynamic battlefield operations, many factors influence the ability for these activities to occur in the reserved time, location, or altitude provided during A2C2 planning. Examples can include delays, faster or slower advances, friendly or enemy advances, unexpected enemy activities, or execution errors.

C-33. The sophistication of new weapons and BAS allows for more immediate and automatic transmission of parametric data regarding airspace use. When available, the TAIS uses this information to automatically compare (monitor) the execution accuracy of the airspace user to that of the planned execution for that airspace user. If an actual or projected variance exists, the TAIS automatically reprocesses this variance for conflict to existing and projected (planned) airspace use to determine conflicts. If conflict exists, the TAIS enters its functional "Conduct Deconfliction Operations." This process remains cyclical, as needed, with continuing receipt of automated data.

C-34. By directly observing the display and monitoring voice communications of airspace users, the TAIS operator scrutinizes the real-time UAP execution activities, compares them with the expected parameters, and identifies actual or potential variance. If actual or potential variance exists, the TAIS operator automatically reviews this variance for conflict to existing and projected (planned) airspace use to determine conflict. If conflict exists, the TAIS operator uses the system's functional "Conduct Deconfliction Operations" by either automated or manual modes. The manual function may include appropriate AIC coordination with airspace users before initiating action.

Adapt to Unit Airspace Plan Change

C-35. When conducting A2C2 operations, changes in airspace use requirements will occur. For TAIS operations, these changes are functionally separated into planned and unplanned ACM changes. These changes may be received automatically or manually by voice or data communications. The major impacts of these changes on A2C2 operations and TAIS functioning are processing requirements and time availability.

C-36. A planned ACM change occurs when operations span time periods that can be hours in length, can be phased, or can be objectively progressive (future actions relying on previous success). With all these variables present once a planned operation starts, a high probability exists that changes will be required later in time but within the execution cycle of the current operation. Since some time will be available to input these changes, they are less reactive time-wise than unplanned execution changes. Each planned ACM change, addition, and deletion will require full TAIS reprocessing (Conduct Deconfliction Operations) of all data to ensure continued synchronization of the operation with the changed parameters. Unplanned ACM changes are more time-sensitive, are more reactive than proactive in nature, and result in unforeseen changes.

C-37. The ability to repetitively identify and resolve airspace conflicts in real-time during A2C2 operations is the single most important functional requirement for TAIS. It represents one of the major "value added" applications of automation to A2C2. The functional steps to accomplish this conflict resolution are the same as those for A2C2 planning. Time-sensitive execution of these steps is necessary to ensure synchronized near real-time operations.

Deconflict Airspace Usage and Process to Appropriate Echelon

C-38. In A2C2 operations, airspace users attempting to use operational airspace at the same location, time, and altitude generate airspace usage conflicts. Due to the real-time nature of A2C2 operations, mission changes—

new or modified, ACM-protected, locations, times, or altitudes required—or user deviations—operations outside the previously approved, ACM-protected, locations, times, or altitudes—predominantly cause this conflict.

C-39. For A2C2 purposes, ACMs are used to identify operational airspace for specified uses, users, locations, times, and altitudes. The TAIS automatically receives message sets and graphics that delineate ACM requests by parameters of use, user, location, time, and altitude. The TAIS operator can also manually input ACMs either through data input or free-draw, on-screen graphics that are internally converted to data. Both manual means also delineate ACM parameters in location, time, and altitude.

C-40. As the TAIS receives this ACM data, the system automatically stores the data and graphically plots the ACM on the planning map. Simultaneously, the system compares the parameters of each ACM resident in the database for any overlap in location, time, and altitude. Once the ACM set is deemed deconflicted and additional ACMs are received or inputted affecting the period of operational planning, the functional cycle will immediately revert to the parameter comparison functional step of "Identify Airspace Conflicts." This step becomes a dynamic cyclical function leading to total airspace deconfliction either through no noted conflicts, conflict resolution, or risk acceptance. Conflict resolution and risk acceptance may require additional coordination through the AIC directly to airspace users.

Provide Feedback to ARFOR Elements on Airspace Usage

C-41. When an ACM is approved, command echelons down to the requestor will be notified of the action. Two notification methods are used:

- Notification by data communication (preferred). This function is an automated data message (query and response free-text) that is automatically formatted, addressed, and presented to the TAIS operator for transmission approval. The TAIS operator also can manually construct a free-text message. The TAIS will internally generate and maintain a retrievable status report on these messages.
- Notification by voice communication. This function will be a voice communication from the TAIS operator to the controlling headquarters.

Forward ACMs and Airspace Usage Conflicts to Affected Elements

C-42. This function is direct notification of the actual airspace users in conflict. Due to time requirements or fratricide potential, this notification method may take priority over notifications to C2 elements. This method will also be used for those airspace users who have no controlling headquarters, for those airspace users whose headquarters cannot be reached, or for any other reason that dictates direct contact. The airspace users with the remaining conflict will be notified directly of the conflict for further coordination or acceptance of the risk. The AIC is notified to coordinate and resolve conflicts with ongoing airborne operations. The ACM request information has a source and destination location via the ABCS address book. TAIS software ensures that receivers acknowledge receipt of messages. Failure to acknowledge message receipt generates a prompt to the TAIS operator that the message has not been received. The operator then knows he must transmit the message by other means. He will use these methods for notification:

- Notify by data communication (preferred). This function will be an automated data message that is automatically formatted, addressed, and presented to the TAIS operator for transmission approval. The TAIS operator also can manually construct a free-text message. The TAIS will internally generate and maintain a retrievable status report on these messages.
- Notify by voice communication. This function will be a voice communication from the TAIS operator directly to the airspace users in conflict notifying them of the conflict and the accepted risk decision. This method will be used to notify nonautomated users. The TAIS will prompt the operator for manual transmission of this message and track or record completion of the notification.

Revise Unit Airspace Plan

C-43. Once all ACM changes and accept risk decisions have been inputted and deconflicted, the TAIS will internally revise all system deliverables to reflect the updated information. Internally, this process may be modification of previous products or regeneration as long as the revised product is appropriately date-time coded. Receiving users, controllers, or C2 elements must recognize the code as the most current product. For A2C2 operations, the following A2C2 deliverables would be subject to this functional revision process:

- *ATO information*. Any approved change to ATO information received from the ACA automated airspace planning system will alert the TAIS operator who can view the data for use in A2C2 planning and operations. Any change to ATO information generated by the TAIS-supported unit (echelon) will require approval from the ACA automated airspace planning system.
- *A2C2 overlay*. Self-explanatory and previously defined.
- *ACO information*. Any approved change to ACO information received from the JFACC automated airspace planning system will be directly incorporated and integrated into the UAP of the TAIS-supported unit (echelon). Any change to ACO information generated by the TAIS-supported unit (echelon) will require approval from the controlling JFACC automated airspace planning system.
- *Special instructions information*. Any approved change to special instructions received from the JFACC automated airspace planning system is directly incorporated and integrated into the UAP of the TAIS-supported unit (echelon). Any change to special instructions generated by the TAIS-supported unit (echelon) requires approval from the controlling JFACC automated airspace planning system.
- *A2C2 annex*. Since the A2C2 annex serves as the A2C2 order and provides the procedural guidance for the particular operation, the likelihood (due to time and ongoing operations) of totally revising this deliverable during an operation is low. An A2C2 fragmentary order is used to address only those orders or procedures necessary to affect realigned operations.
- *A2C2 SOP information*. Since SOP information is generic and broad in application, the likelihood of permanent revisions is low. Operation-

specific SOP changes or expanded SOP procedures of a temporary nature may be required to streamline A2C2 operations.

C-44. If an aviation procedure guide is developed and maintained as a living document (Microsoft Word format) in the TAIS automation database, then the G3 air can approve updates and make them available to users. Approach and en route procedures for tactical instruments must have the approval of ATS battalion or group standardization before being submitted to the G3 air for final approval and inclusion.

Retransmit A2C2 Deliverables

C-45. The ability of the TAIS to retrieve the UAP and transition it to real-time operations by constantly adjusting and deconflicting for time and situational changes is paramount for effective A2C2 operations. The ability to transmit this total two- or three-dimensional, integrated COP to appropriate commanders and airspace users through ABCS is critical. (The other ABCSs will only be able to see a two-dimensional picture. Only another TAIS can display the three-dimensional picture.) This near real-time, deconflicted, and synchronized TAIS product should be a commander's critical information request as an on-demand display on the MCS. The ability to retransmit changed versions in near real-time is crucial.

AIC FUNCTIONS

C-46. The AIC is the primary ATS facility that provides airspace information services and coordinates Army, joint, civil, and combined air traffic operating within the area of operations. All AICs in theater form a system that interfaces with the joint, combined, and host-nation airspace management systems. The AIC primary function is to deconflict, separate, and monitor airspace users.

AIC OPERATIONS

C-47. The TAIS increases the AIC capabilities to meet joint airspace management requirements. The common airspace planning picture—coupled with near real-time surveillance data and more efficient reliable communications to air vehicles—quantitatively improves the AIC operations over those formerly performed with the AN/TSC-61B, flight coordination central.

TAIS DIGITAL NETWORK

C-48. TAIS relies on integrating with the ABCS, TBMCS, and civil aviation systems to access the most complete data essential for airspace management. TAIS also draws information from direct and indirect external sources to provide a near real-time air picture. To achieve this full integration, TAIS primarily uses the communications and mission equipment shown in Table C-1 to link into those networks.

Table C-1. Communication Links

Equipment	Network	Link	Purpose
AN/VRC-90F SINCGARS	Tactical Internet (TI)	Data	Data link to TI and back-up voice tactical FM radio.
AN/VRC-92E SINCGARS (2 R/Ts)	Operational ground and aviation FM nets	Voice	Voice communications with ground forces and tactical Army aviation elements. TAIS monitors appropriate frequencies; there is also a dedicated TAIS FM frequency per the SOI.
AN/VRC-83 HAVE QUICK Radio Set	UHF-AM	HAVE QUICK assigned SOI tactical aviation frequency	Secure frequency-hopping voice communications with aviation assets. TAIS monitors appropriate aviation frequencies; there is no dedicated TAIS UHF frequency.
AN/VRC-83 HAVE QUICK Radio Set	UHF-AM	HAVE QUICK assigned SOI tactical aviation frequency	Secure frequency-hopping voice communications with aviation assets. TAIS monitors appropriate aviation frequencies; there is no dedicated TAIS UHF frequency.
AN/VRC-83 HAVE QUICK Radio Set	VHF-AM	Assigned SOI tactical aviation frequency	Secure voice communications with aviation assets. TAIS monitors appropriate aviation frequencies; there is no dedicated TAIS VHF frequency.
AN/VRC-83 HAVE QUICK Radio Set	VHF-AM	Assigned SOI tactical aviation frequency	Secure voice communications with aviation assets. TAIS monitors appropriate aviation frequencies; there is no dedicated TAIS VHF frequency.
AN/ARC-220 HF Radio Set	HF (ALE)	Voice	(1) Long-range NLOS communications with any HF equipped platform. Automatic link establishment (ALE) communicates with ARC-220 equipped aircraft. (2) Long range TAIS-to-TAIS communications.
TADIL-A, HF (95-S)	AWACS/CRC TADIL-A	Assigned SOI frequency (dedicated) to AWACS or CRC	Receiver of air track data used for battle tracking and airspace procedures compliance.
SATCOM, UHF (PSC-5)	UHF-TACSAT	Assigned SOI frequency	Warfighter net (1) Long-range communications with SATCOM-equipped aircraft. (2) Long-range (over the horizon) TAIS-to-TAIS communications.
UHF/VHF COMM (URC 200)	UHF-AM VHF-AM	Assigned SOI tactical aviation frequencies and UHF/VHF guard	Nonsecure commercial off the shelf air traffic control radio. Primarily used to monitor and transmit on UHF and VHF guard frequencies.
AN/VSQ-2 EPLRS Radio Set	TI and FAAD EO	Assigned SOI	Radio data link capability. Provides common tactical picture, VMF, data messaging, and TAIS-to-TAIS link.
2 x Secure Telephones (DNVT)		Supporting communications SEN	Telephones that provide voice and data (TADIL-B) communication.
4-Channel Modem	FAAD	Ethernet LAN via AN/VRC-90F SINCGARS	Modem that receives air track data used for battle tracking and airspace procedures compliance.
Signal Entry Panel	ABCS	TOC LAN	Panel that accesses ABCS data used to receive and transmit situational and airspace procedures data.
Signal Entry Panel	TADIL-B	TOC LAN	Panel that receives air track data used for battle tracking and airspace procedures compliance.

Table C-1. Communication Links (continued)

Equipment	Network	Link	Purpose
Signal Entry Panel	TBMCS	TOC LAN	Panel that accesses TBMCS data used to receive or transmit situational and airspace procedures data.
Signal Entry Panel	Voice and Data (TADIL-B)	Landline	Panel that uses nine voice lines for AIC and A2C2 communications needs and one data line for TADIL-B.
KG40/40X Encrypter	N/A	HF	Device to encrypt HF (95-S) radio.
KY-68 Encrypter	N/A	MSE/DNVT	Device to encrypt MSE and DNVT radio.

AM–amplitude modulation
AN–Army-Navy
ARC–aircraft radio configuration
AWACS–Airborne Warning and Control System
COMM–communications
CRC–control and reporting center
DNVT–digital nonsecure voice terminal
EO–electro-optical
EPLRS–Enhanced Position Location Reporting System
FM–frequency modulation
HF–high frequency
KG–encription device
KY–encription device
MSE–mobile subscriber equipment
NLOS–non line of sight
PSC–portable satellite configuration
R/T–receiver/transmitter
SATCOM–satellite communications
SEN–small extension node
SINCGARS–Single-channel Ground and Airborne Radio System
SOI–signal operating instructions
TACSAT–-tactical satellite
TOC–tactical operations center
UHF–ultra high frequency
URC–universal radio configuration
VHF–very high frequency
VRC–vehicular radio communications
VSQ–vehicular satellite quest

C-49. The lowest echelon for TAIS employment is division. However, significant A2C2 coordination occurs below the division level. To fully incorporate A2C2 throughout all echelons, the MCS and Aviation Mission Planning System fulfill the airspace management role for brigade and below. The MCS serves as the enabling system since it is designed to cross-level information with the other ATCCSs.

TAIS MESSAGING

C-50. The TAIS primarily uses the USMTF and variable message format (VMF) to receive data from other ABCSs. These messages are passed via LAN to the TAIS or retrieved from the joint common database. Table C-2 on page C-16 depicts the messages TAIS sends and receives.

Table C-2. Messages Used by TAIS

ABCS Component	Receives from TAIS			Sends to TAIS		
AFATDS (Artillery)	A659* F015 F756*	F002 F541 S201*	F014 F658*	F002 F541	F014 F658*	F015 S201*
AMDPCS (Air Defense)	A659* F015 F756*	F002 F541 K01.1	F014 F658* S201*	E500 F015 K01.1	F002 F541 S201*	F014 F658*
ASAS (Intelligence)	C002 F014 F658*	C203 F015 K01.1	F002 F541 S201*	C002 F014 F658* S309	C203 F015 K01.1	F002 F541 S201*
CSSCS (Service Support)	F002 F541 S201*	F014 F658*	F015 K01.1	D630 F014 F631 S201*	D851 F015 F658*	F002 F541 K01.1
DTSS (Geospatial Information)	F002 F541	F014	F015	F002 F541	F014	F015
IMETS (Weather Data)	F002 F541	F014 K01.1	F015	C520 F002 F541	C521 F014 K01.1	C523 F015
ISYSCON (Network Data)	F002 F541	F014 K01.1	F015	C002 F014	C120 F015	F002 F541
MCS (Maneuver)	A659 F002 F541 K01.1	C002 F014 F658* S201*	C400 F015 F756 S507	A423 C203 C447 C503 C506 E400 F015 F756 S201*	A659 C400 C488 C504 C507 F002 F541 G489 S507	C002 C443 C501 C505 C508 F014 F658* K01.1 S303
FBCB2	K01.1	K05.2	K05.17	K01.1	K05.2	K05.17
GCCS-A	F002 F402	F014 F541	F015 S201*	F002 F541	F014 S201*	F015

AFATDS–Advanced Field Artillery Tactical Data System
AMDPCS–Air and Missile Defense Planning and Control System
ASAS–All Source Analysis System
DTSS–Digital Topographic Support System
IMETS–Integrated Meteorological System
ISYSCON–integrated systems control
FBCB2–Force XXI Battle Command Brigade and Below System
GCCS-A–Global Command and Control System-Army
**TAIS automatically fills and posts*

USMTF AND VMF TITLES

C-51. Table C-3 lists a summary of the key A2C2 USMTF and VMF titles used by TAIS. Appendix A discusses these messages in detail.

Table C-3. USMTF and VMF Titles

Number	Title	Number	Title
A423	Order	D630	Airlift Request
A659	Air Tasking Order	D851	Air Evacuation Request
C002	Message Correction/Cancellation	E400	Operations Plan Change
C120	Meaconing, Intrusion, Jamming, and Interference Feeder Report	E500	Air Early Warning Message
C203	Graphical Report-Overlay	F002	General Administration Message
C400	Commander's Situation Report	F014	Request for Information
C443	NBC 3 Report	F015	Response to Request for Information
C447	NBC 4 Report	F541	Acknowledge Message
C488	NBC 1 Report	F658	Airspace Control Means Request
C501	NBC 5 Report	F756	Airspace Control Order
C503	NBC Effective Downwind Report	G489	NBC 2 Report
C504	Friendly Chemical Strike Message	S201	Support-Battlefield Geometry
C505	Friendly Nuclear Strike Warning	S507	Resource
C506	NBC 6 Report	K01.1	Free Text
C507	NBC Chemical Downwind Report	K05.2	Nuclear, Biological Chemical Report One
C508	NBC Basic Wind Report	K05.17	Overlay Message